

2010 Minerals Yearbook

GEMSTONES

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In 2010, the estimated value of natural gemstones produced in the United States was more than \$10.0 million, and the estimated value of U.S. laboratory-created gemstone production was more than \$30.8 million. The total estimated value of U.S. gemstone production was about \$40.8 million. The value of U.S. gemstone imports was \$19.6 billion, and the value of combined U.S. gemstone exports and reexports was estimated to be \$14.9 billion.

In this report, the terms "gem" and "gemstone" mean any mineral or organic material (such as amber, pearl, petrified wood, and shell) used for personal adornment, display, or object of art because it possesses beauty, durability, and rarity. Of more than 4,000 mineral species, only about 100 possess all these attributes and are considered to be gemstones. Silicates other than quartz are the largest group of gemstones in terms of chemical composition; oxides and quartz are the second largest (table 1). Gemstones are subdivided into diamond and colored gemstones, which in this report designates all natural nondiamond gems. In addition, laboratory-created gemstones, cultured pearls, and gemstone simulants are discussed but are treated separately from natural gemstones (table 2). Trade data in this report are from the U.S. Census Bureau. All percentages in the report were computed using unrounded data. Current information on industrial-grade diamond and industrial-grade garnet can be found in the U.S. Geological Survey (USGS) Minerals Yearbook, volume I, Metals and Minerals, chapters on industrial diamond and industrial garnet, respectively.

Gemstones have fascinated humans since prehistoric times. They have been valued as treasured objects throughout history by all societies in all parts of the world. Amber, amethyst, coral, diamond, emerald, garnet, jade, jasper, lapis lazuli, pearl, rock crystal, ruby, serpentine, and turquoise are some of the first stones known to have been used for making jewelry. These stones served as symbols of wealth and power. Today, gems are worn more for pleasure or in appreciation of their beauty than to demonstrate wealth. In addition to jewelry, gemstones are used for collections, decorative art objects, and exhibits.

Production

U.S. gemstone production data were based on a survey of more than 240 domestic gemstone producers conducted by the USGS. The survey provided a foundation for projecting the scope and level of domestic gemstone production during the year. However, the USGS survey did not represent all gemstone activity in the United States, which includes thousands of professional and amateur collectors. Consequently, the USGS supplemented its survey with estimates of domestic gemstone production from related published data, contacts with gemstone dealers and collectors, and information gathered at gem and mineral shows. Commercial mining of gemstones has never been extensive in the United States. More than 60 varieties of gemstones have been produced commercially from domestic mines, but most of the deposits are relatively small compared with those of other mining operations. In the United States, much of the current gemstone mining is conducted by individual collectors, gem clubs, and hobbyists rather than by businesses.

The commercial gemstone industry in the United States consists of individuals and companies that mine gemstones or harvest shell and pearl, firms that manufacture laboratory-created gemstones, and individuals and companies that cut and polish natural and laboratory-created gemstones. The domestic gemstone industry is focused on the production of colored gemstones and on the cutting and polishing of large diamond stones. Industry employment is estimated to be between 1,000 and 1,200.

Most natural gemstone producers in the United States are small businesses that are widely dispersed and operate independently. The small producers probably have an average of less than three employees, including those who only work part time. The number of gemstone mines operating from year to year fluctuates because the uncertainty associated with the discovery and marketing of gem-quality minerals makes it difficult to obtain financing for developing and sustaining economically viable operations.

The total value of natural gemstones produced in the United States during 2010 was estimated to be about \$10.0 million (table 3). This production value was an 8% increase from that of 2009.

Natural gemstone materials indigenous to the United States are collected or produced in every State. During 2010, all 50 States produced at least \$1,360 worth of gemstone materials. There were 10 States that accounted for 85% of the total value, as reported by survey respondents. These States were, in descending order of production value, North Carolina, Arizona, Oregon, Utah, California, Tennessee, Montana, Colorado, Idaho, and Arkansas. Some States were known for the production of a single gemstone material—Tennessee for freshwater pearls, for example. Other States produced a variety of gemstones; for example, Arizona's gemstone deposits included agate, amethyst, azurite, chrysocolla, garnet, jade, jasper, malachite, obsidian, onyx, opal, peridot, petrified wood, smithsonite, and turquoise. There was also a wide variety of gemstones found and produced in California, Idaho, Montana, and North Carolina.

In 2010, the United States had only one active operation in a known diamond-bearing area in Crater of Diamonds State Park near Murfreesboro in Pike County, AR. The State of Arkansas maintains a dig-for-fee operation for tourists and rockhounds at the park; Crater of Diamonds is the only diamond mine in the world that is open to the public. The diamonds occur in a lamproite breccia tuff associated with a volcanic pipe and in the soil developed from the lamproite breccia tuff. In 2010, 601 diamond stones with an average weight of 0.218 carat were recovered at the Crater of Diamonds State Park. Of the 601 diamond stones recovered, 23 weighed more than 1 carat. Since the diamond-bearing pipe and the adjoining area became a State park in 1972, 29,906 diamond stones with a total carat weight of 5,981.1 have been recovered (Margi Jenks, park interpreter, Crater of Diamonds State Park, written commun., September 22, 2011). Exploration has demonstrated that this diamond deposit contains about 78.5 million metric tons (Mt) of diamond-bearing rock (Howard, 1999, p. 62). An Arkansas law enacted early in 1999 prohibits commercial diamond mining in the park (Diamond Registry Bulletin, 1999).

A few companies have expressed interest in exploration for diamond deposits in areas of Alaska, Colorado, Minnesota, Montana, and Wyoming with geologic settings and terrain that are similar to Canadian diamond mining areas. Even though some exploration has taken place in these States, they remain largely unexplored for diamonds (Iron Range Resources & Rehabilitation Board, 2012). Although exploration and field studies have found many diamond indicators and a number of large diamond deposits, none have attracted long-term investors or been operated commercially.

In addition to natural gemstones, laboratory-created gemstones and gemstone simulants were produced in the United States in 2010. Laboratory-created or synthetic gemstones have the same chemical, optical, and physical properties as the natural gemstones. Simulants have an appearance similar to that of a natural gemstone material, but they have different chemical, optical, and physical properties. Laboratory-created gemstones that have been produced in the United States include alexandrite, cubic zirconia, diamond, emerald, garnet, moissanite, ruby, sapphire, spinel, and turquoise. However, during 2010, only cubic zirconia, diamond, moissanite, and turquoise were produced commercially. Simulants of amber, chrysocolla, coral, lapis lazuli, malachite, travertine, and turquoise also were manufactured in the United States. In addition, certain colors of laboratory-created sapphire and spinel, used to represent other gemstones, are classified as simulants.

Laboratory-created gemstone production in the United States was valued at more than \$30.8 million during 2010, which was a 13% increase compared with that of 2009. The value of U.S. simulant gemstone output was estimated to be more than \$100 million. Five companies in five States, representing virtually the entire U.S. laboratory-created gemstone industry, reported production to the USGS. The States with reported laboratory-created gemstone production were, in descending order of production value, Florida, New York, Massachusetts, North Carolina, and Arizona.

Since the 1950s, when scientists manufactured the first laboratory-created bits of diamond grit using a high-pressure, high-temperature (HPHT) method, this method of growing diamonds has become relatively commonplace in the world as a technology for laboratory-created diamonds, so much so that thousands of small plants throughout China were using the HPHT method and producing laboratory-created diamonds suitable for cutting as gemstones. Gem-quality diamonds of 1 carat or more are harder to manufacture because at that size, it is difficult to consistently produce diamonds of high quality, even in the controlled environment of a laboratory using the HPHT method. After more than 50 years of development, that situation has changed, and several laboratory-created diamond companies were producing high-quality diamonds that equal those produced from mines (Park, 2007).

Gemesis Corp. (Sarasota, FL) consistently produced gem-quality laboratory-created diamond and reported an 11th year of production in 2010. The laboratory-created diamonds are produced using equipment, expertise, and technology developed by a team of scientists from Russia and the University of Florida. The weight of the laboratory-created diamond stones ranges from 1¹/₂ to 2 carats, and most of the stones are brownish yellow, colorless, green, and yellow. Gemesis uses diamond-growing machines, each machine capable of growing 3-carat rough diamonds by generating HPHT conditions that recreate the conditions in the Earth's mantle where natural diamonds form (Davis, 2003). Gemesis could be producing as many as 30,000 to 40,000 stones each year, and annual revenues may reach \$70 million to \$80 million. Gemesis diamonds are available for retail purchase in jewelry stores and on the Internet, and the prices of the Gemesis laboratory-created diamonds are 30% to 50% lower than those of comparable natural diamond but above the prices of simulated diamond (Gemesis Corp., 2010).

In the early 2000s, Apollo Diamond, Inc., near Boston, MA, developed and patented a method for growing single, extremely pure, gem-quality diamond crystals by chemical vapor deposition (CVD). The CVD technique transforms carbon into plasma, which is then precipitated onto a substrate as diamond. CVD had been used for more than a decade to cover large surfaces with microscopic diamond crystals, but in developing this process, Apollo Diamond discovered the temperature, gas composition, and pressure combination that resulted in the growth of a single diamond crystal. These CVD diamonds may not be distinguishable from natural diamond by some tests (Davis, 2003). Apollo Diamond produced laboratory-created stones that ranged from 1 to 2 carats. Growth of CVD diamonds is limited only by the size of the seed placed in the diamond-growing chamber. In 2008, the company increased its production of large stones and sold the diamonds at prices that averaged 15% less than those of comparable natural diamonds on the company Web site and through select jewelers (Apollo Diamond, Inc., 2008). Both Apollo Diamond and Gemesis prefer to call their diamonds "cultured" rather than laboratory-created, referring to the fact that the diamonds are grown much like a cultured pearl is grown.

In 2010, Charles & Colvard, Ltd. in North Carolina entered its 13th year as the world's only manufacturer of moissanite, a gem-quality laboratory-created silicon carbide. Moissanite is also an excellent diamond simulant, but it is being marketed for its own gem qualities. Moissanite exhibits a higher refractive index (brilliance) and higher luster than diamond. Its hardness is between those of corundum (ruby and sapphire) and diamond, which gives it durability (Charles & Colvard, Ltd., 2010). Charles & Colvard reported that moissanite sales increased by 53% to \$12.7 million in 2010 compared with \$8.3 million in 2009 (Charles & Colvard, Ltd., 2011). U.S. mussel shells are used as a source of mother-of-pearl and as seed material for culturing pearls. U.S. shell production increased by 15% in 2010 compared with that of 2009 as were a reflection of the recovery from the impacts of the global recession on luxury spending. This increase was in spite of decreased demands for U.S. shell materials caused by the use of manmade seed materials and seed materials from China and other sources by pearl producers in Japan. The popularity of darker and colored pearls and freshwater pearls that do not use U.S. seed materials. In some regions of the United States, shell from mussels was being used more as a gemstone based on its own merit rather than as seed material for pearls. This shell material was being processed into mother-of-pearl and used in beads, jewelry, and watch faces.

Consumption

Historically, diamond gemstones have proven to hold their value despite wars or economic depressions, but this did not hold true during the recent worldwide economic recession. Diamond and colored gemstones value and sales decreased during the economic downturn in 2008 and continued into 2009, but during 2010 U.S. gemstone consumption and sales increased.

Although the United States accounted for little of the total global gemstone production, it was the world's leading diamond and nondiamond gemstone market. It was estimated that U.S. gemstone markets accounted for more than 35% of world gemstone demand in 2010. The U.S. market for unset gem-quality diamond during the year was estimated to be about \$18.6 billion, an increase of 46% compared with that of 2009. Domestic markets for natural, unset nondiamond gemstones totaled approximately \$959 million in 2010, which was a 23% increase from that of 2009. These large increases in domestic markets were a reflection of the recovery from the impacts of the global recession on luxury spending.

In the United States, a majority of domestic consumers designate diamond as their favorite gemstone. This popularity of diamonds is evidenced by the U.S. diamond market making up 95% of the total U.S. gemstone market. Colored natural gemstones, colored laboratory-created gemstones, and "fancy" colored diamonds were popular in 2010, with the values of the domestic markets for almost all types of colored natural, unset nondiamond gemstones increased from the 2009 values (table 10), also owing to recovery from the impact of the recession on luxury spending.

The estimated U.S. retail jewelry sales were \$63.4 billion in 2010, an increase of 7.7% from sales of \$58.8 billion in 2009 (Gassman, 2011). Twenty-five percent of all U.S. jewelers reported jewelry sales increased 20% or more from that of the previous year during the 2010 holiday shopping season (Graff, 2011).

Prices

Gemstone prices are governed by many factors and qualitative characteristics, including beauty, clarity, defects, demand, durability, and rarity. Diamond pricing, in particular, is complex; values can vary significantly depending on time, place, and the subjective valuations of buyers and sellers. There are more than 14,000 categories used to assess rough diamond and more than 100,000 different combinations of carat, clarity, color, and cut values used to assess polished diamond.

Colored gemstone prices are generally influenced by market supply and demand considerations, and diamond prices are supported by producer controls on the quantity and quality of supply. Values and prices of gemstones produced and (or) sold in the United States are listed in tables 3 through 5. In addition, customs values for diamonds and other gemstones imported, exported, or reexported are listed in tables 6 through 10.

De Beers Group companies remain a significant force, influencing the price of gem-quality diamond sales worldwide during 2010 because the companies mine a significant portion of the world's gem-quality diamond produced each year. In 2010, De Beers produced 33 million carats from its independently owned and joint-venture operations in Botswana, Canada, Namibia, and South Africa. De Beers companies also sorted and valuated a large portion (by value) of the world's annual supply of rough diamond through De Beers' subsidiary Diamond Trading Co. (DTC). DTC sales of rough diamonds totaled \$5.08 billion during 2010—up \$1.85 billion from 2009. DTC rough diamond average prices increased by 27% from those of 2009. In 2010, De Beers had diamond sales of \$5.88 billion, which was an increase of 53% from diamond sales of 2009. These increases were driven by strong demand in Chinese and Indian markets (Lee, 2011).

Foreign Trade

During 2010, total U.S. gemstone trade with all countries and territories was valued at about \$34.5 billion, which was a increase of 43% from that of 2009. Diamond accounted for about 95% of the 2010 gemstone trade total. In 2010, U.S. exports and reexports of diamond were shipped to 95 countries and territories, and imports of all gemstones were received from 99 countries and territories (tables 6-10). In 2010, U.S. import quantities in cut diamond increased by 24% compared with those of 2009, and their value increased by 45%. U.S. import quantities in rough and unworked diamond decreased by 44%, although their value increased by 81% (table 7). The United States remained the world's leading diamond importer and was a significant international diamond transit center as well as the world's leading gem-quality diamond market. In 2010, U.S. export quantities of gem-grade diamond increased by 80% compared with those of 2009, and their value increased by 33%. The large volume of reexports revealed the significance that the United States had in the world's diamond supply network (table 6). These increases in trade were owing to recovery from the impact of the recession on luxury spending.

Import values of laboratory-created gemstone increased by 10% for the United States in 2010 compared with those of 2009 (table 10). Again, this increase in imports was owing to recovery from the impact of the recession on luxury spending.

Laboratory-created gemstone imports from Austria, China, Germany, Hong Kong, India, Switzerland, and Thailand, with more than \$500,000 in imports each, made up about 91% (by value) of the total domestic imports of laboratory-created gemstones during the year (table 9). The marketing of imported laboratory-created gemstones and enhanced gemstones as natural gemstones, and the mixing of laboratory-created materials with natural stones in imported parcels, continued to be problems for some domestic producers in 2009. There also were continuing problems with some simulants being marketed as laboratory-created gemstones during the year.

World Review

The gemstone industry worldwide has two distinct sectors diamond mining and marketing and colored gemstone production and sales. Most diamond supplies are controlled by a few major mining companies; prices are supported by managing the quality and quantity of the gemstones relative to demand, a function performed by De Beers through DTC. Unlike diamond, colored gemstones are primarily produced at relatively small, low-cost operations with few dominant producers; prices are influenced by consumer demand and supply availability.

In 2010, world natural diamond production totaled about 144 million carats—79.9 million carats gem quality and 63.8 million carats industrial grade (table 11). Most production was concentrated in a few regions—Africa [Angola, Botswana, Congo (Kinshasa), Namibia, and South Africa], Asia (northeastern Siberia and Yakutia in Russia), Australia, North America (Northwest Territories in Canada), and South America (Brazil and Venezuela). In 2010, Russia led the world in total natural diamond output quantity (combined gemstone and industrial) with 23% of the world estimated production. Botswana was the world's leading gemstone diamond producer with 31%; followed by Russia, 22%; Angola, 16%; Canada, 15%; Congo (Kinshasa), 7%; South Africa, 4%; Namibia, 2%; and Guinea, 1%. These eight countries produced 97% (by quantity) of the world's gemstone diamond output in 2010.

In 2002, the international rough-diamond certification system, the Kimberley Process Certification Scheme (KPCS), was agreed upon by United Nations (UN) member nations, the diamond industry, and involved nongovernmental organizations to prevent the shipment and sale of conflict diamonds. Conflict diamonds are diamonds that originate from areas controlled by forces or factions opposed to legitimate and internationally recognized governments, and are used to fund military action in opposition to those governments, or in contravention of the decisions of the UN Security Council. The KPCS includes the following key elements: the use of forgery-resistant certificates and tamper-proof containers for shipments of rough diamonds; internal controls and procedures that provide credible assurance that conflict diamonds do not enter the legitimate diamond market; a certification process for all exports of rough diamonds; the gathering, organizing, and sharing of import and export data on rough diamonds with other participants of relevant production; credible monitoring and oversight of the international certification scheme for rough diamonds; effective enforcement of the provisions of the certification scheme through dissuasive and proportional penalties for violations; self regulation by the diamond industry that fulfills minimum requirements; and sharing information with all other participants on relevant rules, procedures, and legislation as well as examples of national certificates used to accompany

shipments of rough diamonds. Israel assumed the chair of KPCS for January 1 through December 31, 2010, the eighth country or organization in succession to hold the chair after Namibia, India, South Africa, Canada, Russia, Botswana, and the European Commission. The 50 participants represented 76 nations (including the 27 member nations of the European Community) plus the rough diamond-trading entity of Taipei. During 2010, Côte d'Ivoire continued to be under UN sanctions and was not trading in rough diamonds, and Venezuela voluntarily suspended exports and imports of rough diamonds until further notice. The participating nations in the KPCS account for approximately 99.8% of the global production and trade of rough diamonds (Kimberley Process, undated).

Globally, the value of production of natural gemstones other than diamond was estimated to be more than \$2.5 billion in 2010. Most nondiamond gemstone mines are small, low-cost, and widely dispersed operations in remote regions of developing nations. Foreign countries with major gemstone deposits other than diamond are Afghanistan (aquamarine, beryl, emerald, kunzite, lapis lazuli, ruby, and tourmaline), Australia (beryl, opal, and sapphire), Brazil (agate, amethyst, beryl, ruby, sapphire, topaz, and tourmaline), Burma (beryl, jade, ruby, sapphire, and topaz), Colombia (beryl, emerald, and sapphire), Kenya (beryl, garnet, and sapphire), Madagascar (beryl, rose quartz, sapphire, and tourmaline), Mexico (agate, opal, and topaz), Sri Lanka (beryl, ruby, sapphire, and topaz), Tanzania (garnet, ruby, sapphire, tanzanite, and tourmaline), and Zambia (amethyst and beryl). In addition, pearls are cultured throughout the South Pacific and in other equatorial waters; Australia, China, French Polynesia, and Japan were key producers in 2010.

Worldwide diamond exploration allocations decreased by 9% in 2010, to \$357 million spent by 99 companies compared with \$393 million by 113 companies during 2009. This lowered the diamond share of overall worldwide mineral exploration spending to 3% during 2010. Planned diamond exploration spending in 2010 was at its lowest value since 2003. Africa was the most popular diamond exploration location for the seventh year in a row, although Africa's share of overall exploration spending decreased to 35% in 2010 from almost 50% in 2009. Canada's share of total diamond exploration budgets increased to 29% in 2010 from 18% in 2009. De Beers Group dropped from the position of top diamond explorer that it had held for more than a decade and was replaced by ALROSA Co. Ltd. ALROSA, De Beers Group, and Rio Tinto plc were the three leading diamond exploration companies, accounting for 57% of the estimated \$357 million total global diamond exploration budget in 2010 (Metals Economics Group, 2010, p. 8-9; 2011, p. 13).

Worldwide in 2010, diamond prices recovered strongly from the downturn caused by the global recession. The recovery was led by an upturn in the U.S. markets; this was demonstrated by increasing quantity and value of diamond imports in 2010 and improved sales in North America overall (Metals Economics Group, 2011, p. 10).

Worldwide in 2010, three diamond mines started up, including one mine reopening. One of the startups was in Botswana, one in Brazil, and the reopening was in South Africa (Metals Economics Group, 2011, p. 15). **Botswana.**—Firestone Diamonds plc received a license for mining the BK11 Mine in July 2010, and began operating phase I of the production plant. Work on phase 2 was completed in the third quarter of 2010, increasing the ore production rate to 1.5 million metric tons (Mt) per year. The mine reached full production of 150,000 carats per year in the fourth quarter of 2010. The BK11 Mine is an open pit operation, which is 90% owned by Firestone Diamonds plc and 10% by a local company. Firestone estimated the BK11 Mine's reserves to be 18.0 Mt at startup (Metals Economics Group, 2011, p. 15).

Brazil.—During the third quarter of 2010, Vaaldiam Mining Inc. started production at its Duas Barras alluvial mining operation. Diamond recovery during the quarter was 643 carats from ore grading 0.03 carat per cubic meter. The ore grade improved after September with the opening of a second mining front that exposed large amounts of better quality gravels. The recovered diamond grade was approximately 0.16 carat per cubic meter. Vaaldiam estimated the reserves for Duas Barras at 2.3 Mt (Metals Economics Group, 2011, p. 15).

Canada.—Canadian diamond production was about 11.8 million carats (Mct) during 2010, an increase of about 8% compared with that of 2009. Diamond exploration continued in Canada, with several commercial diamond projects and additional discoveries in Alberta, British Columbia, the Northwest Territories, the Nunavut Territory, Ontario, and Quebec. In 2010, Canada produced 8.2% of the world's combined natural gemstone and industrial diamond output.

The Diavik Diamond Mine in the Northwest Territories completed its eighth full year of production. In 2010, Diavik produced 6.5 Mct of diamond, an increase of 16% from the previous year's production. At yearend 2010, Diavik estimated the mine's remaining proven and probable reserves to be 18 Mt of ore in kimberlite pipes containing 52.2 Mct of diamond and projected the total mine life to be 16 to 22 years. Diavik began developing an underground mine and substantially completed construction on the project during 2009, and the first ore was produced during the first quarter of 2010, with full production expected in 2013. The mine is an unincorporated joint venture between Diavik Diamond Mine Inc. (60%) and Harry Winston Diamond Mines Ltd. (40%) (Diavik Diamond Mine Inc., 2011; Perron, 2011, p. 2).

The Ekati Diamond Mine completed its twelfth full year of production in 2010. Ekati produced 2.89 Mct of diamond from 4.85 Mt of ore. BHP Billiton Ltd. has an 80% controlling ownership in Ekati, which also is in the Northwest Territories. Ekati has estimated remaining reserves of 38.5 Mt of ore in kimberlite pipes that contain 18.3 Mct of diamond. BHP Billiton projected the remaining mine life to be 12 years. Approximately 21% of the Ekati 2010 production is industrial-grade diamond (BHP Billiton Ltd., 2011, p. 10; Perron, 2011, p. 1).

The Jericho Diamond Mine is in Nunavut and was originally owned by Tahera Diamond Corp. Tahera estimated Jericho Diamond Mine's reserves to be about 5.5 Mt of ore grading 0.85 carat per ton. In 2008, the Jericho Diamond Mine experienced startup problems related to ore mining and processing. The mine also suffered financial problems owing to the cost of transporting supplies to the mine site, high operational costs, high oil prices, and appreciation of the Canadian dollar versus the U.S. dollar. All of these problems combined to force the company to enter into protection under Canada's "Companies' Creditors Arrangement Act" on January 16, 2008, and the mine suspended production on February 6, 2008. At yearend 2009, Tahera was finalizing arrangements to sell all of its Jericho Mine assets (Perron, 2011, p. 2). In July 2010, Shear Minerals Ltd. (now known as Shear Diamonds Ltd.) announced that it had entered into a purchase agreement with Tahera and Benachee Resources Inc. to acquire a 100% interest in the Jericho Diamond Mine, the mine's processing facilities, and all supporting exploration assets in the Kitikmeot region of Nunavut (Shear Minerals Ltd., 2010). Shear Minerals completed the acquisition of the Jericho Diamond Mine in August 2010 with the intention of bringing the mine back into production (Shear Minerals Ltd., 2011).

The Snap Lake Mine, which is wholly owned by De Beers Canada Inc., is in the Northwest Territories. The Snap Lake deposit is a tabular-shaped kimberlite dyke rather than the typical kimberlite pipe. The dyke is 2.5 meters thick and dips at an angle of 12° to 15°. The deposit was mined using a modified room and pillar underground mining method in 2010. The Snap Lake Mine started mining operations in October 2007, reached commercial production levels in the first quarter of 2008, and officially opened on June 25, 2008. The mine was expected to produce 1.4 Mct per year of diamond, and the mine life was expected to be about 20 years. The mine's production for 2010 was 926,000 carats for a recovered grade of 1.2 carats per metric ton (De Beers Canada Inc., 2011; Perron, 2011, p. 2–3).

The Victor Mine, which also is wholly owned by De Beers Canada, is in northern Ontario on the James Bay coast. The Victor kimberlite consists of two pipes with surface area of 15 hectares (37.1 acres). The Victor Mine initiated mining operations at yearend 2007 and was officially opened on July 26, 2008. The Victor Mine reportedly has 27.4 Mt of ore with average ore grade of 0.23 carat per metric ton estimated minable reserves. At full capacity, the open pit mine was expected to produce 600,000 carats per year, and the mine life was expected to be about 12 years. In 2010, the mine's production was 826,000 carats recovered from 2.67 Mt of ore (De Beers Canada Inc., undated; Perron, 2011, p. 3).

South Africa.—Petra Diamonds Ltd. has operated the Kimberley Underground Mines under care-and-maintenance status since 2007. De Beers had closed the mines in August 2005. In September 2007, Petra Diamonds began the process of purchasing De Beers interests in the mines and began rehabilitating the deep underground diamond mines. Petra Diamonds purchased the Kimberley diamond operations from De Beers for \$11 million, and Petra Diamonds was given approval to operate the mines under De Beers' licence. After completing the mine rehabilitation, Petra Diamonds reopened the underground mine in September 2010. Petra had been producing from tailings and stockpile for the previous few years. During the fourth quarter of 2010, Kimberley produced 25,000 carats grading 0.14 carat per metric ton, and sold 17,300 carats at an average price of \$285 per carat. The Kimberley Mines are 74% owned by Petra Diamonds and 26% by Sedibeng Mining (Pty) Ltd. Petra Diamonds estimated the Kimberley Mine's reserves to be 57.0 Mt. Kimberley's annual production was expected to be 100,000 carats

from the processing of 1 Mt per year of ore (Metals Economics Group, 2011, p. 15; Petra Diamonds Ltd., undated).

Outlook

As the domestic and global economy improves, Internet sales of diamonds, gemstones, and jewelry were expected to continue to expand and increase in popularity, as were other forms of e-commerce that emerge to serve the diamond and gemstone industry. Internet sales are expected to add to and partially replace "brick-and-mortar" sales. This is likely to take place as the gemstone industry and its customers become more comfortable with and learn the applications of new e-commerce tools, such as sales Web sites and online social networking Web sites (Dayrit, 2011).

As more independent producers, such as Ekati and Diavik in Canada, come online they will bring a greater measure of competition to global markets that presumably will bring more supplies and lower prices. Further consolidation of diamond producers and larger quantities of rough diamond being sold outside DTC is expected to continue as the diamond industry adjusts to De Beers' reduced influence on the industry.

More laboratory-created gemstones, simulants, and treated gemstones are likely to enter the marketplace and necessitate more transparent trade industry standards to maintain customer confidence.

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			Practical			Specific		Refractive	May be	Recognition
Name	Composition	Color	size ¹	Cost^2	Mohs	gravity	Refraction	index	confused with	characteristics
Amber	Hydrocarbon	Yellow, red, green, blue	Any	Low to	2.0-2.5	1.0 - 1.1	Single	1.54	Synthetic or pressed	Fossil resin, color, low
				medium					plastics, kaurigum	density, soft, insects.
Apatite	Chlorocalcium	Colorless, pink, yellow,	Small	Low	5.0	3.16-3.23	Double	1.63 - 1.65	Amblygonite, andalusite,	Crystal habit, color,
	phosphate	green, blue, violet							brazilianite, precious	hardness, appearance.
									beryl, titanite, topaz,	
									tourmaline	
Azurite	Copper carbonate	Azure, dark blue, pale	Small to	do.	3.5-4.0	3.7–3.9	do.	1.72 - 1.85	Dumortierite, hauynite,	Color, softness, crystal
	hydroxide	blue	medium						lapis lazuli, lazulite,	habits, associated
									sodalite	minerals.
Benitoite	Barium titanium	Blue, purple, pink,	do.	High	6.0-6.5	3.64–3.68	do.	1.76 - 1.80	Sapphire, tanzanite,	Strong blue in ultraviolet
	silicate	colorless							blue diamond, blue	light.
									tourmaline, cordierite	
Beryl:										
Aquamarine	Beryllium aluminum	Blue-green to light blue	Any	Medium to	7.5-8.0	2.63-2.80	do.	1.58	Synthetic spinel, blue	Double refraction,
	silicate			high					topaz	refractive index.
Bixbite	do.	Red	Small	Very high	7.5-8.0	2.63-2.80	do.	1.58	Pressed plastics,	Refractive index.
									tourmaline	
Emerald, natural	do.	Green	Medium	do.	7.5	2.63-2.80	do.	1.58	Fused emerald, glass,	Emerald filter, dichroism,
									tourmaline, peridot,	refractive index.
									green garnet doublets	
Emerald, synthetic	do.	do.	Small	High	7.5-8.0	2.63-2.80	do.	1.58	Genuine emerald	Lack of flaws, brilliant
										fluorescence in
										ultraviolet light.
Golden (heliodor)	do.	Yellow to golden	Any	Low to	7.5-8.0	2.63-2.80	do.	1.58	Citrine, topaz, glass,	Weak-colored.
				medium					doublets	
Goshenite	do.	Colorless	do.	Low	7.5-8.0	2.63–2.80	do.	1.58	Quartz, glass, white	Refractive index.
									sapphire, white topaz	
Morganite	do.	Pink to rose	do.	do.	7.5-8.0	2.63-2.80	do.	1.58	Kunzite, tourmaline,	Do.
									pink sapphire	
Calcite:										
Marble	Calcium carbonate	White, pink, red, blue,	do.	do.	3.0	2.72	Double	1.49–1.66	Silicates, banded agate,	Translucent.
		green, or brown					(strong)		alabaster gypsum	
Mexican onyx	do.	do.	do.	do.	3.0	2.72	do.	1.6	do.	Banded, translucent.
Charoite	Hydrated sodium	Lilac, violet, or white	Small to	do.	5.0-6.0	2.54-2.78	XX	1.55 - 1.56	Purple marble	Color, locality.
	calcium hydroxi-		medium							
	fluoro-silicate									
See footnotes at end of	c table.									

TABLE 1—Continued GUIDE TO SELECTED GEMSTONES AND GEM MATERIALS USED IN JEWELRY

;			Practical	ç		Specific		Refractive	May be	Recognition
Name	Composition	Color	size	Cost ⁻	Mons	gravity	Kerraction	index	conrused with	cnaracteristics
Chrysoberyl:										
Alexandrite	Beryllium aluminate	Green by direct sunlight, or	Small to	High	8.5	3.50–3.84	Double	1.75	Synthetic	Strong dichroism, color
		encandescent light, red by	medium							varies from red to
		indirect sunlight or								green, hardness.
		fluorescent light								
Cat's eye	do.	Greenish to brownish	do.	do.	8.5	3.50-3.84	do.	1.75	Synthetic, shell	Density, translucence,
										chatoyance.
Chrysolite	do.	Yellow, green, and (or)	Medium	Medium	8.5	3.50–3.84	do.	1.75	Tourmaline, peridot	Refractive index, silky.
		brown								
Chrysocolla	Hydrated copper	Green, blue	Any	Low	2.0-4.0	2.0–2.4	XX	1.46–1.57	Azurite, dyed	Lack of crystals, color,
	silicate								chalcedony, malachite,	fracture, low density,
1		Owners and white black	D	- -	01 20		Dauble	1 40 1 66	Eales sound	Pull to a land
COTAL	Саюнии сагоонае	Orange, reu, while, black, purple, or green	branching, medium	.0D	0. 1 -C.C	1.7-0.7	aronor	1.49–1.00	raise corai	рип папунсеп.
Corundum:										
Ruby	Aluminum oxide	Rose to deep purplish red	Small	Very high	9.0	3.95-4.10	do.	1.78	Synthetics, including	Inclusions, fluorescence.
		Ĭ	;;;;		0			c II	spinel, garnet	
Sapphire, blue	do.	Blue	Medium	High	9.0	3.95-4.10	do.	1.78	do.	Inclusions, double
										refraction, dichroism.
Sapphire, fancy	do.	Yellow, pink, colorless,	Medium to	Medium	0.6	3.95 - 4.10	do.	1.78	Synthetics, glass and	Inclusions, double
		orange, green, or violet	large						doublets, morganite	refraction, refractive
										index.
Sapphire or ruby,	do.	Red, pink, violet, blue, or	do.	High to low	0.6	3.95-4.10	do.	1.78	Star quartz, synthetic	Shows asterism, color
stars		gray							stars	side view.
Sapphire or ruby,	do.	Yellow, pink, blue, green,	Up to 20	Low	9.0	3.95-4.10	do.	1.78	Synthetic spinel, glass	Curved striae, bubble
synthetic		orange, violet, or red	carats							inclusions.
Cubic zirconia	Zirconium and	Colorless, pink, blue,	Small	do.	8.25-8.5	5.8	Single	2.17	Diamond, zircon, titania,	Hardness, density, lack
	yttrium oxides	lavender, yellow							moissanite	of flaws and inclusions,
										reiracuve index.
Diamond	Carbon	White, blue-white,	Any	Very high	10.0	3.516-3.525	do.	2.42	Zircon, titania, cubic	High index, dispersion,
		yellow, brown, green, red nink blue							zirconia, moissanite	hardness, luster.
Feldspar:		ver, prins, oue								
Amazonite	- Alkali aluminum	Green-blue	Large	Low	6.0 - 6.5	2.56	XX	1.52	Jade. turanoise	Cleavage, sheen, vitreous
	silicate)						4	to pearly, opaque, grid.
Labradorite	do.	Gray with blue and	do.	do.	6.0 - 6.5	2.56	XX	1.56	do.	Do.
		bronze sheen color play								
See footnotes at end o	of table.									

			Practical			Specific		Refractive	May be	Recognition
Name	Composition	Color	size ¹	Cost^2	Mohs	gravity	Refraction	index	confused with	characteristics
Moonstone	Alkali aluminum silicate	Colorless, white, gray, or yellow with white, blue or bronze schiller	Large	Low	6.0-6.5	2.77	XX	1.52–1.54	Glass, chalcedony, opal	Pale sheen, opalescent.
Sunstone	do.	Orange, red brown, colorless with gold or red glittery schiller	Small to medium	do.	6.0-6.5	2.77	XX	1.53–1.55	Aventurine, glass	Red glittery schiller.
Garnet	Complex silicate	Brown, black, yellow, green, red, or orange	do.	Low to high	6.5–7.5	3.15-4.30	Single strained	1.79–1.98	Synthetics, spinel, glass	Single refraction, anomalous strain.
Hematite	Iron oxide	Black, black-gray, brown-red	Medium to large	Low	5.5-6.5	5.12-5.28	XX	2.94-3.22	Davidite, cassiterite, magnetite, neptunite, pyrolusite, wolffamite	Crystal habit, streak, hardness.
Jade: Indaite	Comulav eilioata	Green vallow block	arrea	I out to varu	0239	3 3 2 V	Cerunto_	1 65 1 68	Nanhrita chalcadony	Tuetar chaotrium
		white, or mauve		high			crystalline		onyx, bowenite, vesuvianite, grossularite	translucent to opaque.
Nephrite	Complex hydrous silicate	Green, yellow, black, white, or mauve	do.	Low to very high	6.0-6.5	2.96–3.10	do.	1.61–1.63	Jadeite, chalcedony, onyx, bowenite, vesuvianite, grossularite	Do.
Jet (gagate)	Lignite	Deep black, dark brown	do.	Low	2.5-4.0	1.19–1.35	XX	1.64–1.68	Anthracite, asphalt, cannel coal, onyx, schorl, glass, rubber	Luster, color.
Lapis lazuli	Sodium calcium aluminum silicate	Dark azure-blue to bright indigo blue or even a pale sky blue.	do.	do.	5.0-6.0	2.50-3.0	XX	1.5	Azurite, dumortierite, dyed howlite, lazulite, sodalite, glass	Color, crystal habit, associated minerals, luster, localities.
Malachite	Hydrated copper carbonate	Light to black-green banded	do.	do.	3.5-4.0	3.25-4.10	XX	1.66–1.91	Brochantite, chrysoprase, opaque green gemstones	Color banding, softness, associated minerals.
Moissanite	Silicon carbide	Colorless and pale shades of green, blue, yellow	Small	Low to medium	9.25	3.21	Double	2.65–2.69	Diamond, zircon, titania, cubic zirconia	Hardness, dispersion, lack of flaws and inclusions, refractive index.
Obsidian	Amorphous, variable (usually felsic)	Black, gray, brown, dark green, white, transparent	Large	Low	5.0-5.5	2.35–2.60	XX	1.45–1.55	Aegirine-augite, gadolinite, gagate, hematite, pyrolusite, wolframite	Color, conchoidal fracture, flow bubbles, softness, lack of crystal faces.

TABLE 1—Continued GUIDE TO SELECTED GEMSTONES AND GEM MATERIALS USED IN JEWELRY

See footnotes at end of table.

			Practical			Specific		Refractive	May be	Recognition
Name	Composition	Color	size ¹	Cost^2	Mohs	gravity	Refraction	index	confused with	characteristics
Opal	Hydrated silica	Reddish orange, colors flash in white gray, black, red, or yellow	Large	Low to high	5.5-6.5	1.9–2.3	Single	1.45	Glass, synthetics, triplets, chalcedony	Color play (opalescence).
Peridot	Iron magnesium	Yellow and or green	Any	Medium	6.5–7.0	3.27–3.37	Double (strong)	1.65–1.69	Tourmaline, chrysoberyl	Strong double refraction,
Quartz:	aurono						(Sino ne)			
Agate	Silicon dioxide	Any	Large	Low	7.0	2.58-2.64	XX	XX	Glass, plastic, Mexican	Cryptocrystalline,
									onyx	irregularly banded,
										dendritic inclusions.
Amethyst	do.	Purple	do.	Medium	7.0	2.65–2.66	Double	1.55	Glass, plastic, fluorite	Macrocrystalline, color,
										refractive index,
										transparent, hardness.
Aventurine	do.	Green, red-brown,	do.	Low	7.0	2.64–2.69	do.	1.54 - 1.55	Iridescent analcime,	Macrocrystalline, color,
		gold-brown, with metallic							aventurine feldspar,	metallic iridescent flake
		iridescent reflection							emerald, aventurine	reflections, hardness.
									glass	
Cairngorm	do.	Smoky orange or yellow	do.	do.	7.0	2.65-2.66	do.	1.55	do.	Macrocrystalline, color,
										refractive index,
										transparent, hardness.
Carnelian	do.	Flesh red to brown red	do.	do.	6.5-7.0	2.58-2.64	do.	1.53-1.54	Jasper	Cryptocrystalline, color,
										hardness.
Chalcedony	do.	Bluish, white, gray	do.	do.	6.5-7.0	2.58-2.64	do.	1.53-1.54	Tanzanite	Do.
Chrysoprase	do.	Green, apple-green	do.	do.	6.5-7.0	2.58-2.64	Double	1.53-1.54	Chrome chalcedony,	Do.
									jade, prase opal,	
									prehnite, smithsonite,	
									variscite, artificially	
									colored green	
Ctimes.	0 70	Vello	(-7	-		22 1 22 1	c T	1 55	LIIAICCUUILY	Monocomptolling color
Clurine	d 0.	renow	.00	00.	0.7	00.7-00.7	00.	CC.1	d0.	Macrocrystanne, color, refractive index
										transparent, hardness.
Jasper	do.	Any, striped, spotted, or	do.	do.	7.0	2.58-2.66	XX	XX	do.	Cryptocrystalline,
		sometimes uniform								opaque, vitreous luster,
										hardness.
Onyx	do.	Many colors	do.	do.	7.0	2.58–2.64	XX	XX	do.	Cryptocrystalline,
										hardness.
See footnotes at en	1 of table.									

TABLE 1—Continued GUIDE TO SELECTED GEMSTONES AND GEM MATERIALS USED IN JEWELRY

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		GUIDE TO S	ELECTED GEN	TABLE 1— ASTONES ANI	Continued D GEM MA	TERIALS US	SED IN JEWE	ILRY		
			Practical			Specific		Refractive	May be	Recognition
Name	Composition	Color	size ¹	$Cost^2$	Mohs	gravity	Refraction	index	confused with	characteristics
Petrified wood	Silicon dioxide	Brown, gray, red, yellow	Large	Low	6.5-7.0	2.58–2.91	Double	1.54	Agate, jasper	Color, hardness, wood
										grain.
Rock crystal	do.	Colorless	do.	do.	7.0	2.65–2.66	do.	1.55	Topaz, colorless sapphire	Do.
Rose	do.	Pink, rose red	do.	do.	7.0	2.65-2.66	do.	1.55	do.	Macrocrystalline, color,
										refractive index,
		:								transparent, naroness.
Tiger's eye	do.	Golden yellow, brown, red. blue-black	do.	do.	6.5-7.0	2.58-2.64	XX	1.53–1.54	XX	Macrocrystalline, color, hardness, chatovancy.
Dhodochrocita	Mananasa carhonata	Does rad to wallowich	40	do	10	315 37	Double	16197	Eira onal shodonita	Color owned habit
NIIOUOCIIIOSIUE	Manganese caroonate	rose-reu to yenowish, strinned	.00	.00	4.0	1.6-04.0	aronor	1.0-1.02	rue opai, mouonue, monnite tourmaline	Colot, crystal liabit, reaction to acid merfect
		mdding							ugupuc, commune	rhombohedral cleavage.
Rhodonite	Manganese iron	Dark red, flesh red, with	do.	do.	5.5-6.5	3.40-3.74	do.	1.72-1.75	Rhodochrosite, thulite,	Color, black inclusions,
	calcium silicate	dendritic inclusions of							hessonite, spinel,	lack of reaction to acid,
		black manganese oxide							pyroxmangite,	hardness.
									spessartine, tourmaline	
Shell:										
Mother-of-pearl	Calcium carbonate	White, cream, green,	Small	do.	3.5	2.6 - 2.85	XX	XX	Glass and plastic	Luster, iridescent play
		blue-preen. with							imitation	of color.
		iridescent play of color								
Pearl	do.	White, cream to black,	do.	Low to high	2.5-4.5	2.6-2.85	XX	XX	Cultured and glass or	Luster, iridescence,
		sometimes with hint of							plastic imitation	x-ray of internal
		pink, green, purple								structure.
Spinel, natural	Magnesium	Any	Small to	Medium	8.0	3.5-3.7	Single	1.72	Synthetic, garnet	Refractive index, single
	aluminum oxide		medium							refraction, inclusions.
Spinel, synthetic	do.	do.	Up to 40	Low	8.0	3.5-3.7	Double	1.73	Spinel, corundum, beryl,	Weak double refraction,
			carats						topaz, alexandrite	curved striae, bubbles.
spodumene:										
Hiddenite	Lithium aluminum	Yellow to green	Medium	Medium	6.5–7.0	3.13–3.20	do.	1.66	Synthetic spinel	Refractive index, color,
	SIIICALE									predent or still.
Kunzite	do.	Pink to lilac	do.	do.	6.5-7.0	3.13–3.20	Double	1.66	Amethyst, morganite	Do.
Tanzanite	Complex silicate	Blue to lavender	Small	High	6.0-7.0	3.3	do.	1.69	Sapphire, synthetics	Strong trichroism, color.
Topaz	Lithium aluminum	White, blue, green, pink,	Medium	Low to	8.0	3.4 - 3.6	do.	1.62	Beryl, quartz	Color, density, hardness,
	silicate	yellow, gold		medium						refractive index, perfect in basal cleavage.
Tourmaline	do.	Any, including mixed	do.	do.	7.0-7.5	2.98-3.20	do.	1.63	Peridot, bervl. garnet	Double refraction. color.
		0			:	l			corundum, glass	refractive index.

GUIDE TO SELECTED GEMSTONES AND GEM MATERIALS USED IN JEWELRY TABLE 1—Continued

			Practical			Specific		Refractive	May be	Recognition
Name	Composition	Color	size ¹	Cost^2	Mohs	gravity	Refraction	index	confused with	characteristics
Turquoise	Copper aluminum	Blue to green with black,	Large	Low	6.0	2.60-2.83	Double	1.63	Chrysocolla, dyed	Difficult if matrix not
	phosphate	brown-red inclusions							howlite, dumortierite,	present, matrix usually
									glass, plastics, variscite	limonitic.
Unakite	Granitic rock,	Olive green, pink,	do.	do.	6.0 - 7.0	2.60-3.20	XX	XX	XX	Olive green, pink,
	feldspar, epidote,	and blue-gray								gray-blue colors.
	quartz									
Zircon	Zirconium silicate	White, blue, brown, yellow,	Small to	Low to	6.0–7.5	4.0-4.8	Double	1.79–1.98	Diamond, synthetics,	Double refraction,
		or green	medium	medium			(strong)		topaz, aquamarine	strongly dichroic, wear
										on facet edges.
Do. do. Ditto, XX No	ot annlicable.									

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¹Small: up to 5 carats; medium: 5 to 50 carats; large: more than 50 carats. ²Low: up to \$25 per carat; medium: up to \$200 per carat; high: more than \$200 per carat.

TABLE 2 LABORATORY-CREATED GEMSTONE PRODUCTION METHODS

Gamstona	Production method	Company/producer	Date of first production
A law and date	Floor	Company/producer	
Alexandrite	Flux	Creative Crystals Inc.	1970s.
Do.	Melt pulling	J.O. Crystal Co., Inc.	1990s.
Do.	do.	Kyocera Corp.	1980s.
Do.	Zone melt	Seiko Corp.	Do.
Cubic zirconia	Skull melt	Various producers	1970s.
Emerald	Flux	Chatham Created Gems	1930s.
Do.	do.	Gilson	1960s.
Do.	do.	Kyocera Corp.	1970s.
Do.	do.	Lennix	1980s.
Do.	do.	Russia	Do.
Do.	do.	Seiko Corp.	Do.
Do.	Hydrothermal	Biron Corp.	Do.
Do.	do.	Lechleitner	1960s.
Do.	do.	Regency	1980s.
Do.	do.	Russia	Do.
Ruby	Flux	Chatham Created Gems	1950s.
Do.	do.	Douras	1990s.
Do.	do.	J.O. Crystal Co., Inc.	1980s.
Do.	do.	Kashan Created Ruby	1960s.
Do.	Melt pulling	Kyocera Corp.	1970s.
Do.	Verneuil	Various producers	1900s.
Do.	Zone melt	Seiko Corp.	1980s.
Sapphire	Flux	Chatham Created Gems	1970s.
Do.	Melt pulling	Kyocera Corp.	1980s.
Do.	Verneuil	Various producers	1900s.
Do.	Zone melt	Seiko Corp.	1980s.
Star ruby	Melt pulling	Kyocera Corp.	Do.
Do.	do.	Nakazumi Earth Crystals Co.	Do.
Do.	Verneuil	Linde Air Products Co.	1940s.
Star sapphire	do.	do.	Do.

Do., do. Ditto.

TABLE 3 ESTIMATED VALUE OF U.S. NATURAL GEMSTONE PRODUCTION, BY GEM TYPE $^{\rm l}$

(Thousand	dollars)
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Gem materials	2009	2010
Beryl	918 ^r	1,700
Coral, all types	150	150
Diamond	(2)	(2)
Garnet	148	149
Gem feldspar	858	693
Geode/nodules	105	110
Opal	225	189
Quartz:	_	
Macrocrystalline ³	231	273
Cryptocrystalline ⁴	216	208
Sapphire/ruby	256	344
Shell	713	821
Topaz	(2)	(2)
Tourmaline	112	95
Turquoise	531	449
Other	4,850	4,840
Total	9,310 ^r	10,000

^rRevised.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Less than ¹/₂ unit.

³Macrocrystalline quartz (crystals recognizable with the naked eye) includes amethyst, aventurine, blue quartz, citrine, hawk's eye, pasiolite, prase, quartz cat's eye, rock crystal, rose quartz, smoky quartz, and tiger's eye.

⁴Cryptocrystalline quartz (microscopically small crystals) includes agate, carnelian, chalcedony, chrysoprase, fossilized wood, heliotrope, jasper, moss agate, onyx, and sard.

TABLE 4 PRICES PER CARAT OF U.S. CUT ROUND DIAMONDS, BY SIZE AND QUALITY IN 2010

Carat	Description,	Clarity ¹	R	epresentative pr	ices
weight	color ²	(GIA terms)	January ³	June ⁴	December ⁵
0.25	G	VS1	\$1,400	\$1,400	\$1,400
Do.	G	VS2	1,300	1,300	1,300
Do.	G	SI1	1,200	1,200	1,200
Do.	Н	VS1	1,350	1,350	1,350
Do.	Н	VS2	1,250	1,250	1,250
Do.	Н	SI1	1,150	1,150	1,150
0.50	G	VS1	2,650	2,650	2,650
Do.	G	VS2	2,200	2,200	2,200
Do.	G	SI1	1,900	1,900	1,900
Do.	Н	VS1	2,350	2,350	2,350
Do.	Н	VS2	2,150	2,150	2,150
Do.	Н	SI1	1,800	1,800	1,800
1.00	G	VS1	6,400	6,400	6,400
Do.	G	VS2	5,450	5,450	5,450
Do.	G	SI1	4,650	4,650	4,650
Do.	Н	VS1	5,300	5,300	5,300
Do.	Н	VS2	4,800	4,800	4,800
Do.	Н	SI1	4,225	4,225	4,225
2.00	G	VS1	11,400	11,900	12,100
Do.	G	VS2	10,900	11,200	11,500
Do.	G	SI1	8,800	8,800	9,100
Do.	Н	VS1	9,300	9,300	9,500
Do.	Н	VS2	9,000	9,000	9,100
Do.	Н	SI1	8,000	8,000	8,250

Do. Ditto.

¹Clarity: IF—no blemishes; VVS1—very, very slightly included; VS1—very slightly included; VS2—very slightly included, but not visible; SI1—slightly included.

²Gemological Institute of America (GIA) color grades: D—colorless; E—rare white; G, H, I—traces of color.

³Source: The Gem Guide, v. 29, no. 1, January/February 2010, p. 20–22.

⁴Source: The Gem Guide, v. 29, no. 4, July/August 2010, p. 20–22.

⁵Source: The Gem Guide, v. 29, no. 6, November/December 2010, p. 20–22.

TABLE 5 PRICES PER CARAT OF U.S. CUT COLORED GEMSTONES IN 2010

	Price rat	nge per carat
Gemstone	January ¹	December ²
Amethyst	\$10-25	\$10-25
Blue sapphire	900-1,650	950-1,800
Blue topaz	5-10	5-10
Emerald	2,400-4,000	2,400-4,000
Green tourmaline	50-70	50-70
Cultured saltwater pearl ³	5	5
Pink tourmaline	70–150	70–150
Rhodolite garnet	20-40	22-45
Ruby	1,850-2,200	1,850-2,200
Tanzanite	300-375	300-375

¹Source: The Gem Guide, v. 29, no. 1, January/February 2010, p. 48, 51, 55, 59, 61, 63, and 66–69. These figures are approximate wholesale purchase prices paid by retail jewelers on a per stone basis for 1 to less than 1 carat fine-quality stones.

²Source: The Gem Guide, v. 29, no. 6, November/December 2010, p. 50, 53, 57, 61, 63, 65, and 68–71. These figures are approximate

wholesale purchase prices paid by retail jewelers on a per-stone basis for 1 to less than 1 carat fine-quality stones.

³Prices are per 4.5–5-millimeter pearl.

TABLE 6 U.S. EXPORTS AND REEXPORTS OF DIAMOND (EXCLUSIVE OF INDUSTRIAL DIAMOND), BY COUNTRY $^{\rm 1}$

	2009		2010		
	Quantity	Value ²	Quantity	Value ²	
Country	(carats)	(millions)	(carats)	(millions)	
Exports:	(11111)	()	()	()	
Australia	37.600	\$21	33.000	\$34	
Belgium	300.000	150	346.000	396	
Canada	46,600	70	52.000	87	
Costa Rica	8,470	2	9.430	2	
France	49,200	25	33.000	94	
Hong Kong	807,000	380	1,910,000	448	
India	962,000	477	1,300,000	825	
Israel	960,000	482	419,000	365	
Japan	17,800	5	3,400	9	
Mexico	504,000	79	561,000	84	
Netherlands	561	1	1,150	9	
Netherlands Antilles	10,600	23	12,700	34	
Singapore	31.200	13	8.690	10	
South Africa	829	2	636	7	
Switzerland	152,000	146	147,000	177	
Taiwan	12,900	5	9,080	4	
Thailand	86,700	40	92,500	14	
United Arab Emirates	108,000	46	193,000	68	
United Kingdom	27,400	58	325,000	58	
Other	156.000	133	2.250.000	139	
Total	4,280,000	2,160	7,710,000	2,860	
Reexports:					
Armenia	1.670	(3)	1.880	(3)	
Australia	- 59.600	19	16.300	16	
Belgium	4.130.000	1.110	2.410.000	1.600	
Canada	139.000	127	143.000	144	
Dominican Republic	15,300	3	10.500	1	
France	80,800	43	47.900	78	
Guatemala		5	46.000	5	
Hong Kong	3.220.000	1.190	4.340.000	1.820	
India	2,350,000	959	2.730.000	1,900	
Israel	6.940.000	2.750	4.390.000	4.110	
Japan	117.000	24	98.200	32	
Malavsia	9,860	1	2.480	2	
Mexico	2.990	2	5,780	1	
Singapore	193.000	50	65.500	24	
South Africa	66,500	55	29.300	45	
Switzerland	- 584.000	492	429,000	565	
Thailand	145.000	29	160.000	31	
United Arab Emirates	749.000	198	338.000	188	
United Kingdom	383.000	204	166.000	269	
Other	1.710.000	534	598.000	407	
Total	20,900.000	7.780	16.000.000	11.200	
Grand total	25,200,000	9,940	23.700.000	14.100	

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Customs value.

 3 Less than $\frac{1}{2}$ unit.

TABLE 7

U.S. IMPORTS FOR CONSUMPTION OF DIAMOND, BY KIND, WEIGHT, AND COUNTRY $^{\rm 1}$

	2009		2010	
	Quantity	Value ²	Quantity	Value ²
Kind, range, and country of origin	(carats)	(millions)	(carats)	(millions)
Rough or uncut, natural: ³				
Angola	359,000	\$48	67,000	\$132
Australia	17,700	2	8,060	1
Botswana	88,100	35	81,500	68
Brazil	443	(4)		
Canada	27,300	32	35,300	43
Congo (Kinshasa)	11,600	7	6,650	7
Ghana	250	(4)	135	(4)
Guyana	212	(4)	534	(4)
India	32,700	1	12,900	1
Namibia	10,000	6	7,450	9
Russia	16,500	3	37,500	8
South Africa	104,000	112	102,000	223
Other	32,000	43	29,400	31
Total	700,000	289	389,000	524
Cut but unset, not more than 0.5 carat:				
Belgium	344,000	127	281,000	106
Canada	7,910	7	13,000	9
China	25,800	18	37,500	21
Dominican Republic	38,200	10	7,250	2
Hong Kong	239,000	24	180,000	25
India	5,760,000	1,150	7,310,000	1,560
Israel	400,000	198	433,000	207
Mauritius	6,920	15	5,780	15
Mexico	65,900	10	92,300	21
South Africa	1,780	10	9,440	13
Thailand	60,800	17	93,400	14
United Arab Emirates	153,000	30	77,100	17
Other	57,400	39 ^r	63,900	49
Total	7,160,000	1,650	8,610,000	2,060
Cut but unset, more than 0.5 carat:				
Belgium	640,000	2,130	706,000	2,900
Canada	20,200	60	23,300	83
Hong Kong	26,800	76	42,200	102
India	1,110,000	1,930	1,900,000	3,610
Israel	1,670,000	5,350	2,000,000	7,530
Mexico	1,810	3	1,250	1
Russia	57,800	137	25,300	98
South Africa	34,700	533	63,000	892
Switzerland	23,500	238	11,300	391
Thailand	3,980	9	5,910	13
United Arab Emirates	33,900	60	10,100	42
Other	53,200	256	73,800	343
Total	3.670.000	10.800	4.860.000	16.000

^rRevised. -- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Customs value.

³Includes some natural advanced diamond.

⁴Less than ¹/₂ unit.

TABLE 8 U.S. IMPORTS FOR CONSUMPTION OF GEMSTONES, OTHER THAN DIAMOND, BY KIND AND COUNTRY¹

	200	09	2010		
	Quantity	Value ²	Quantity	Value ²	
Kind and country	(carats)	(millions)	(carats)	(millions)	
Emerald:					
Belgium	1,980	\$1	1,340	(3)	
Brazil	500,000	7	120,000	\$7	
Canada	434	(3)	4	(3)	
China	4,150	(3)	13,800	1	
Colombia	314,000	120	406,000	131	
France	315	2	1,480	2	
Germany	8,470	2	54,000	2	
Hong Kong	334,000	23	246,000	17	
India	2,410,000	18	1,810,000	37	
Israel	181,000	20	172,000	17	
Italy	2,380	1	2,880	(3)	
Switzerland	7,980	8	6,290	13	
Thailand	292,000	8	487,000	10	
United Kingdom	356	1	1,550	2	
Other	38,000	3	89,400	15	
Total	4,090,000	214	3,410,000	254	
Ruby:					
Belgium	10	(3)	16	(3)	
China	2,100	(3)	19,200	(3)	
France	37	(3)	1,730	(3)	
Germany	8,370	(3)	10,900	(3)	
Hong Kong	420,000	1	201,000	1	
India	2,500,000	2	2,310,000	6	
Israel	5,560	1	22,300	(3)	
Italy	1,330	(3)	4,300	(3)	
Kenya	16,700	(3)	1,810	(3)	
Sri Lanka	2,020	1	3,800	(3)	
Switzerland	933	3	129	2	
Thailand	1,750,000	14	1,880,000	22	
United Arab Emirates	64	64 2		(3)	
Other	179,000	179,000 13 168.0		11	
Total	4,880,000	37	4,630,000	42	
Sapphire:					
Australia	2,340	(3)	1,190	(3)	
Austria	472	(3)	3,380	(3)	
Belgium	283	1	2,420	1	
China	122,000	1	56,700	3	
Dominican Republic	600	(3)			
Germany	33,200	5	123,000	4	
Hong Kong	610,000	13	536,000	9	
India	2,140,000	6	2,570,000	20	
Israel	9,780	1	19,300	2	
Italy	15,000	1	5,440	1	
Singapore	3,010	(3)			
Sri Lanka	240,000	31	309,000	66	
Switzerland	14,700 14 13,700		13,700	20	
Thailand	1,730,000 48 2		2,630,000	78	
United Arab Emirates	2,530	2	319	(3)	
United Kingdom	504	1	610	1	

See footnotes at end of table.

TABLE 8—Continued U.S. IMPORTS FOR CONSUMPTION OF GEMSTONES, OTHER THAN DIAMOND, BY KIND AND COUNTRY¹

	20	09	2010		
	Quantity	Value ²	Quantity	Value ²	
Kind and country	(carats)	(millions)	(carats)	(millions)	
Sapphire-Continued:					
Other	68,200	3	44,800	8	
Total	4,990,000	127	6,320,000	214	
Other:					
Rough, uncut, all countries	NA	8	NA	15	
Total	NA	8	NA	15	
Cut, set and unset, all countries	NA	29	NA	32	
Total	NA	29	NA	32	

NA Not available. -- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Customs value.

 3 Less than $\frac{1}{2}$ unit.

TABLE 9 VALUE OF U.S. IMPORTS OF LABORATORY-CREATED AND IMITATION GEMSTONES, BY COUNTRY^{1, 2}

(Thousand dollars)

Country	2009	2010
Laboratory-created, cut but unset:		
Austria	1,430	1,950
Brazil	374	96
Canada	9	
China	7,600	5,700
Czech Republic	42	118
France	284	232
Germany	11,100	10,100
Hong Kong	455	549
India	2,180	9,870
Italy	95	78
Japan	61	25
Korea, Republic of	46	53
Netherlands	5	29
Sri Lanka	315	35
Switzerland	797	500
Taiwan	161	186
Thailand	975	723
United Arab Emirates	98	
Other	3,390	2,050
Total	29,500	32,300
Imitation: ³		
Austria	47,100	51,400
Brazil	2	
China	13,300	13,300
Czech Republic	5,080	5,070
France		5
Germany	566	726
Hong Kong	358	158
India	302	125
Italy	123	164
Korea, Republic of	131	282
Taiwan		25
Thailand	39	28
United Kingdom	3	
Other	208	406
Total	67,200	71,700

-- Zero.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Customs value.

³Includes pearls.

TABLE 10 U.S. IMPORTS FOR CONSUMPTION OF GEMSTONES¹

(Thousand carats and thousand dollars)

	20	009	2010	
Stones	Quantity	Value ²	Quantity	Value ²
Coral and similar materials, unworked	4,430	10,500	5,760	12,000
Diamonds:	-			
Cut but unset	10,800	12,400,000 ^r	13,500	18,100,000
Rough or uncut	700	289,000	389	524,000
Emeralds, cut but unset	4,090	214,000	3,140	254,000
Pearls:	-			
Cultured	NA	26,900	NA	15,800
Imitation	NA	4,150	NA	5,100
Natural	NA	21,100	NA	22,900
Rubies and sapphires, cut but unset	9,880	164,000	10,900	256,000
Other precious and semiprecious stones:	-			
Rough, uncut	1,080,000	15,000	1,400,000	30,700
Cut, set and unset	NA	247,000	NA	276,000
Other	91,100	11,600	78,100	11,300
Laboratory-created:	-			
Cut but unset	8,730	29,500	6,800	32,300
Other	NA	8,240	NA	14,600
Imitation gemstone ³	NA	67,200	NA	66,600
Total	1,200,000	13,500,000 r	1,520,000	19,600,000

^rRevised. NA Not available.

¹Data are rounded to no more than three significant digits; may not add to totals shown.

²Customs value.

³Does not include pearls.

TABLE 11

NATURAL DIAMOND: WORLD PRODUCTION, BY COUNTRY AND TYPE $^{\rm 1,\,2,\,3}$

(Thousand carats)

Country and type ⁴	2006	2007	2008	2009	2010
Gemstones:					
Angola	8,258	8,732	8,016	12,445	12,500 ^e
Armenia	184	123	101	50	50 e
Australia	7,305	231	273	220 ^{r, e}	100 e
Botswana ^e	24,000	25,000	25,000	24,000	25,000
Brazil ^e	181	182	182	200 ^{r, 5}	200
Canada	13,278	17,144	14,803	10,946	11,773
Central African Republic ^e	340	370	302 ^{r, 5}	249 ^{r, 5}	250
China ^e	100	100	100	100	100
Congo (Kinshasa)	5,800	5,700	4,200	3,700 r	5,500
Côte d'Ivoire ^e	^r	^r	r	^r	
Ghana	768	671	478	301 ^r	300 ^e
Guinea	355	815	2,500	557 ^r	550
Guyana	341	269	169	144	144 ^e
Lesotho	231	454	450 ^e	450 ^e	460
Namibia	2,400	2,266	2,435	1,192 ^r	1,200 e
Russia ^e	23,400	23,300	21,925 5	17,791 5	17,800
Sierra Leone	362	362	223	241 r	240 e
South Africa ^e	6,100	6,100	5,200	2,500 r	3,500
Tanzania ^e	230	239	202	155 ^r	77
Venezuela ^e	45	45	45	45	45
Zimbabwe ^e	160	100	100	100	50
Other ⁶	70	75 ^r	121 ^r	79 ^r	70
Total	93,900 ^r	92,300 r	86,800 r	75,500 ^r	79,900
Industrial:					
Angola ^e	918	970	900	1,383 ^{r, 5}	1,300
Australia	21,915	18,960	15,397	10,700	9,900
Botswana ^e	8,000	8,000	8,000	7,000	7,000
Brazil ^e	600	600	600	600	600
Central African Republic ^e	85	93	74 5	62 ^{r, 5}	60
China ^e	965	970	1,000	1,000	1,000
Congo (Kinshasa)	23,100	22,600	16,700	14,600 ^r	22,200
Côte d'Ivoire ^e	^r	^r	r	^r	
Ghana	192	168	120	75 ^r	75 ^e
Guinea	118	200	600	139 ^r	130
Russia ^e	15,000	15,000	15,000	15,000	15,000
Sierra Leone	241	241	149	160 ^r	160 ^e
South Africa ^e	9,100	9,100	7,700	3,600 ^r	5,400
Tanzania ^e	42	44	36 ^r	27	14
Venezuela ^e	70	70	70	70	70
Zimbabwe ^e	900	600	700	850 ^r	800
Other ⁷	67	84 ^r	145 ^r	115 ^r	118
Total	81,300 r	77,700 ^r	67,200 ^r	55,400 ^r	63,800
Grand total	175,000 ^r	170,000 ^r	154,000 ^r	131,000 ^r	144,000

^eEstimated. ^rRevised. -- Zero.

¹World totals and estimated data are rounded to no more than three significant digits; may not add to totals shown. ²Table includes data available through June 2, 2011.

³In addition to the countries listed, Nigeria and the Republic of Korea produce natural diamond and synthetic diamond, respectively, but information is inadequate to formulate reliable estimates of output levels.

TABLE 11—Continued NATURAL DIAMOND: WORLD PRODUCTION, BY COUNTRY AND TYPE $^{\rm 1,\,2,\,3}$

⁴Includes near-gem and cheap-gem qualities.

⁵Reported figure.

⁶Includes Cameroon, Congo (Brazzaville), Gabon (unspecified), India, Indonesia, Liberia, and Togo (unspecified).
⁷Includes Congo (Brazzaville), India, Indonesia, and Liberia.